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10/533,680	05/03/2005	Dominique Placko	28944/40099	8651

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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/533,680	PLACKO ET AL.	
	Examiner	Art Unit	
	Kimberly Thornewell	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 September 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 September 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-29 were originally presented for examination and rejected in the Office Action dated 6/19/2006. In the reply dated 9/21/2006, the Applicant amended all of claims 1-29 and therefore all of claims 1-29 are pending in the instant application.

Response to Arguments

Response: Drawings

2. The Examiner thanks the Applicant for submitting a replacement drawing of Figure 6 with a "Prior Art" label. Accordingly, the objection to the drawings is withdrawn.

Response: Section 112, Second Paragraph Rejections

3. The Applicant amended the claims in order to overcome the rejection for containing grammatical and idiomatic errors. While many of the original errors have been corrected by the Applicant's amendments, some new grounds of rejection are also raised because of the amendments. For example, line 1 of claim 1 makes reference to "a method performed by computer means." The "computer means" is an improper invocation of Section 112, sixth paragraph.

The Applicant further amended claims 18-23 in order to overcome the rejection for the use of alternative language and improper use of multiple dependent claims. The Examiner thanks the Applicant for amending claims 18 and 19 by removing the alternative language and the multiple dependencies of the claims. However, claims 20 and 21 are still in improper multiple dependent format because they are not dependent

from multiple claims in the *alternative*. That is, for example, claim 20 requires limitations to be present from *both* claims 2 and 18, as opposed to either only claim 2 or only claim 18.

Because not all issues have been resolved regarding Section 112, second paragraph, the rejection of the claims is maintained.

Response: Section 101 Rejections

4. The Applicant amended the claims in order to recite an application of the result matrix. More specifically, the Applicant clarified that the matrix system is used a first time to determine the coefficients of a first column matrix, and then at least a second time for calculating the values of a physical quantity in any chosen region of space. The Applicant argued that because the second resulting matrix provides physical quantities of the chosen region of three-dimensional space, a practical application has been set forth.

The Examiner respectfully traverses because the physical quantities of the second matrix are results that are calculated from purely mathematical functions. MPEP 2106.02 states, "A process consisting solely of mathematical operations, i.e., converting one set of numbers into another set of numbers, does not manipulate appropriate subject matter and thus cannot constitute a statutory process." The Applicant still has not set forth the practical application of the quantities of the second matrix once they are calculated.

Response: Section 103 Rejections

5. Applicant's arguments with respect to claims 1-29 have been considered but are moot in view of the new ground(s) of rejection.

Claim Objections

6. It appears that in the Applicant's amendment an attempt was made to remove all of the coefficients from the claim language. However some of the coefficients were left behind. More specifically, in claim 1 line 18, "a physical quantity (V(M))," and in line 19, "said given region (M)," and also in claim 12 line 2, "a region of space (M)" still remain in the claim language.

7. Claims 1 and 29 is objected because in line 14 "characterizes" should be "characterizing." Also the word "at" was inadvertently added at the beginning of the phrase "using the matrix system at least a second time for" in claim 1.

8. Claims 20 and 21 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim should refer to other claims in the alternative only. See MPEP § 608.01(n). Accordingly, the claims have not been further treated on the merits.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claims 1-28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites that the claimed method is performed by computer means. The Applicant has not set forth in the claims how this method is performed by "computer means," as the steps of the method are directed to performing mathematical functions.

Claims 20 and 21 uses improper multiple dependent claim language. The scope of these claims cannot be determined because one cannot tell how the limitations of the parent claims are combined.

All other rejected claims not specifically mentioned are rejected by virtue of their dependence.

Claim Rejections - 35 USC § 101

11. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

12. Claims 1-29 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Independent claim 1 is directed to a method of evaluating a physical quantity associated with an interaction between a wave and an obstacle in a region of three-dimensional space. A matrix system is formed and used a first time for assigning chosen values of a physical quantity to predetermined points, and a second time for applying the interaction matrix to a chosen region of three-dimensional space. Although the matrix is applied to a region of space, the resulting coefficients of the second column matrix are evaluated as a result of pure math. These coefficients have not been stored, displayed, outputted, or otherwise given a practical application; hence the claim is directed to an abstract idea and therefore rendered non-statutory. Claim 29 is

directed to a computer program product that comprises instructions for carrying out steps similar to those listed in claim 1. Because the program product performs a method that is an abstract idea, claim 29 is also rendered non-statutory.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. Claims 1-7, 10-11, 17, 18, 24, and 26-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Placko et al., "A Theoretical Stud of Magnetic and Ultrasonic Sensors: Dependence of Magnetic Potential and Acoustic Pressure on the Sensor Geometry," published in Proceedings of SPIE Vol. 4335, July 2001, in view of Tsingos, "Geometrical Theory of Diffraction for Modeling Acoustics in Virtual Environments," SIGGRAPH 2001.

As per claim 1,

Placko discloses a method performed by computer means of evaluating a physical quantity associated with an interaction between a wave and an obstacle in a region of three-dimensional space, the method comprising the steps:

- Meshing a surface into a plurality of surface samples, at least a part of said samples representing a surface of an obstacle receiving a main wave (**page**

58 second paragraph lines 1-2, *obstacle being a "metallic plane"*), and allocating to each surface sample at least one source emitting an elementary wave (**page 53 section 2.1 lines 3-4**);

- Using a matrix system comprising:
    - An interaction matrix, being invertible, applicable to a given region of space (**page 56 equation 9, F matrix**) and comprising a number of columns corresponding to a total number of sources (**page 53 section 2.2 lines 1-2**);
    - A first column matrix (**page 56 equation 9**, *phi matrix*), each coefficient of said first column matrix being associated with one source and characterizing the elementary wave that said one source emits (**page 53 section 2.1 line 6**);
    - And a second column matrix, obtainable by multiplication of the first column matrix by the interaction matrix, each coefficient of said second column matrix being values of a physical quantity representative of the wave emitted by all of the sources of said given region (**page 56 equation 9, theta matrix**);
- Using the matrix system a first time for assigning chosen values of said physical quantity to predetermined points, each of said predetermined points being associated with a surface sample, placing said chosen values in the second column matrix (**page 53 section 2.1 lines 3-4**), applying the interaction matrix to said predetermined points, and estimating the coefficients of said first column matrix by multiplication of said second

column matrix by the inverse of the interaction matrix determined for said predetermined points (**page 56 equation 11**);

- Using the matrix system at least a second time for applying the interaction matrix to a chosen region of three-dimensional space, multiplying the first column matrix comprising the coefficients estimated in step c) by said interaction matrix determined for said chosen region, to evaluate coefficients of said second column matrix (**page 56 equation 9**);
- Wherein the coefficients of said second column matrix evaluated in step d) correspond to values of said physical quantity in said region of three-dimensional space (**page 55 section 2.2 paragraph 1**, *"magnetic potential"*), each of said predetermined points associated with a surface sample corresponding to a point of contact between said surface sample and a hemisphere (**page 55 Figure 4**).

Placko further discloses the hemisphere having a surface equal to the surface of the surface sample and including at least one source allocated to the surface sample (**page 55 Figure 4**).

Placko does not disclose expressly the obstacle emitting a secondary wave in response to the main wave. Placko further does not disclose expressly the hemisphere being oriented inwardly for a propagation of the secondary wave in the second medium and outwardly for a propagation of the secondary wave in the first medium.

Tsingos discloses modeling acoustics, wherein hemispheres are present on a surface sample when a secondary wave is propagated to an obstacle. These hemispheres are oriented inwardly for a propagation of the secondary wave in the second medium

(**Figure 1**, *transmission through the obstacle*), and outwardly for a propagation of the secondary wave in the first medium (**page 5 Figure 8**, *reflection off of the obstacle*).

It would have been obvious to one of ordinary skill in the art of acoustics modeling, at the time of the present invention, to modify the teachings of Placko to achieve a secondary wave from the obstacle in order to evaluate physical quantities associated with interactions between a main wave and an obstacle in a region of three-dimensional space. It would have also been obvious to further modify the teachings of Placko's hemisphere in order to achieve an inward orientation for diffraction of the wave, and outward for reflection of the wave. The motivation for doing so would have been to use the DPSM (**Placko section 1**) while taking into account both reflection and diffraction of the transmitted wave (**Tsingos Abstract paragraph 1**).

As per claim 2,

Placko discloses determining, by meshing, a plurality of surface samples of an active surface (**page 54 second paragraph line 1**) radiating the main wave (**page 53 section 3.1 lines 1-2**) and allocating a source emitting an elementary wave representing a contribution to the main wave to each sample of the active surface (**page 54 second paragraph lines 1-2**). Placko further discloses applying steps b), c) and d) to the samples of active surface (**page 56 equations 9-11**). Placko further discloses evaluating the quantity representing the interaction between the radiating element and the obstacle, by taken into account the contribution of the main wave emitted by the sources of the active surface and the contribution of the secondary wave emitted by the set of sources of

the surface of the obstacles (*taught as computing reluctance based on magnetic flux, potential and field values*, **page 56 paragraph 5, equation 13**).

As per claim 3,

Placko discloses each coefficient of the interaction matrix being representative of an interaction between a source and a given region of space, and the value of each coefficient being dependent on a distance between a source and the given region (*taught as using C as the coordinate of the center for each source*, **page 55 equation 6**).

As per claim 4,

Placko discloses the interaction matrix comprising a number of rows corresponding to a total number of predetermined points (**page 56 equation 11**, *5 predetermined points, 5 rows in matrix*).

As per claim 5,

Placko discloses the physical quantity being a scalar quantity (**page 56 equation 13**), and a single source being allocated to each surface sample (**page 53 section 2.1 lines 3-4**).

As per claim 6,

Placko does not disclose expressly the interaction matrix comprising a single row. However, this would be an obvious design choice, because if one predetermined point were chosen, there would only be one row in the interaction matrix.

As per claim 7,

Placko discloses each predetermined point corresponding to a point of contact between the surface sample and a hemisphere whose surface is equal to the surface of the surface sample, and whose center corresponds to a position of the source which is allocated to the surface sample (**page 53 figure 1; section 2.1 lines 8-10**).

As per claim 10,

Placko discloses the main wave being a sound wave (**page 58 section 4.1 lines 1-2**), the coefficients of the first column matrix being values of speed of sound that are each associated with a source (**page 59 last two lines**), and the coefficients of the second column matrix being values of acoustic pressure (**page 48 section 4.1 lines 3-4**).

As per claim 11,

Placko discloses the physical quantity to be evaluated being a vector quantity expressed by its three coordinates in three-dimensional space, and three sources being allocated to each surface sample (**page 58 figure 9, section 4.1 second paragraph**).

As per claim 17,

Placko discloses the main wave being a sound wave (**page 58 section 4.1 lines 1-2**), the coefficients of the first column matrix being values of speed of sound that are each associated with a source (**page 59 last two lines**), and the coefficients of the second column matrix being values of acoustic velocity (**page 48 section 4.1 lines 3-4**).

As per claim 18,

Tsingos discloses the secondary wave corresponding to a reflection of the main wave on the obstacle, and the hemisphere being oriented outwards from the obstacle (**page 5 figure 4**). It would be obvious to take the coefficient of reflection into consideration in order to estimate the contribution of the secondary wave because it is well known in the art of wave propagation that when a wave meets a planar object at least a portion of the wave is reflected.

As per claim 24,

Placko discloses the main wave being a sound wave and the coefficients of the interaction matrix each being dependent of on an angle of incidence of an elementary wave emitted from a source in the region (**page 60 section 4.2 paragraph 5 lines 1-5**).

As per claim 26,

Placko discloses the main wave being a sound wave and a total number of surface samples being chosen substantially as a function of wavelength of the sound wave so as to satisfy the Rayleigh criterion (**page 59 second paragraph equation 15**).

As per claim 27,

Placko discloses the plurality of values of the physical quantity obtained for a plurality of regions in space being compared so as to select a candidate region of the placement of a radiating element intended to interact with the obstacle (**page 50 paragraph 3 lines 2-5**).

As per claim 28,

Placko discloses the radiating element being a sensor, for nondestructive testing (**figure 5, page 56 section 3.4 line 2**).

As per claim 29,

Placko discloses a computer program product intended to be run by a processor of a central unit for evaluating a physical quantity associated with an interaction between a wave and an obstacle, in a chosen region of three-dimensional space, wherein the computer program product comprises instructions for:

- Meshing a surface into a plurality of surface samples, at least a part of said samples representing a surface of an obstacle receiving a main wave (**page 58 second paragraph lines 1-2**, *obstacle being a "metallic plane"*), and allocating to each surface sample at least one source emitting an elementary wave (**page 53 section 2.1 lines 3-4**);
- Using a matrix system comprising:
  - An interaction matrix, being invertible, applicable to a given region of space (**page 56 equation 9, F matrix**) and comprising a number of columns corresponding to a total number of sources (**page 53 section 2.2 lines 1-2**);
  - A first column matrix (**page 56 equation 9,** *phi matrix*), each coefficient of said first column matrix being associated with one

source and characterizing the elementary wave that said one source emits (**page 53 section 2.1 line 6**);

- And a second column matrix, obtainable by multiplication of the first column matrix by the interaction matrix, each coefficient of said second column matrix being values of a physical quantity representative of the wave emitted by all of the sources of said given region (**page 56 equation 9, theta matrix**);

- Using the matrix system a first time for assigning chosen values of said physical quantity to predetermined points, each of said predetermined points being associated with a surface sample, placing said chosen values in the second column matrix (**page 53 section 2.1 lines 3-4**), applying the interaction matrix to said predetermined points, and estimating the coefficients of said first column matrix by multiplication of said second column matrix by the inverse of the interaction matrix determined for said predetermined points (**page 56 equation 11**);
- Using the matrix system at least a second time for applying the interaction matrix to a chosen region of three-dimensional space, multiplying the first column matrix comprising the coefficients estimated in step c) by said interaction matrix determined for said chosen region, to evaluate coefficients of said second column matrix (**page 56 equation 9**);
- Wherein the coefficients of said second column matrix evaluated in step d) correspond to values of said physical quantity in said region of three-dimensional space (**page 55 section 2.2 paragraph 1,** *"magnetic*

potential"), each of said predetermined points associated with a surface sample corresponding to a point of contact between said surface sample and a hemisphere (**page 55 Figure 4**).

Placko further discloses the hemisphere having a surface equal to the surface of the surface sample and including at least one source allocated to the surface sample (**page 55 Figure 4**).

Placko does not disclose expressly the obstacle emitting a secondary wave in response to the main wave. Placko further does not disclose expressly the hemisphere being oriented inwardly for a propagation of the secondary wave in the second medium and outwardly for a propagation of the secondary wave in the first medium.

Tsingos discloses modeling acoustics, wherein hemispheres are present on a surface sample when a secondary wave is propagated to an obstacle. These hemispheres are oriented inwardly for a propagation of the secondary wave in the second medium (**Figure 1**, *transmission through the obstacle*), and outwardly for a propagation of the secondary wave in the first medium (**page 5 Figure 8**, *reflection off of the obstacle*).

It would have been obvious to one of ordinary skill in the art of acoustics modeling, at the time of the present invention, to modify the teachings of Placko to achieve a secondary wave from the obstacle in order to evaluate physical quantities associated with interactions between a main wave and an obstacle in a region of three-dimensional space. It would have also been obvious to further modify the teachings of Placko's hemisphere in order to achieve an inward orientation for diffraction of the wave, and outward for reflection of the wave. The motivation for doing so would have been to

use the DPSM (**Placko section 1**) while taking into account both reflection and diffraction of the transmitted wave (**Tsingos Abstract paragraph 1**).

Allowable Subject Matter

15. Claims 8, 9, 12-16, 19, 22, 23 and 25 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

16. The following is a statement of reasons for the indication of allowable subject matter:

Regarding claims 8, 9, 15 and 16,

Although Placko discloses evaluating interactions of magnetic waves, independent claim 1 recites orienting the hemisphere inwardly for a propagation of the secondary wave in the second medium and outwardly for a propagation of the secondary wave in the first medium. Although Tsingos discloses the orientation of the hemispheres in this manner, the reference discusses exclusively sound waves, rather than magnetic or electric waves. Hence, Placko and Tsingos cannot render claims 8, 9, 12 and 13 obvious.

Regarding claim 12,

While Placko teaches the interaction matrix being applied to a region of space, the reference does not teach the matrix comprising a row for each space coordinate.

Regarding claims 13 and 14,

While Placko teaches the sources allocated to each surface sample being substantially in one and the same plane, the reference does not teach each predetermined point associated with a surface sample corresponding to a point of contact between the sample and a hemisphere whose center corresponds to a barycenter of the three sources.

Regarding claims 19 and 23,

While Tsingos teaches the hemisphere being oriented inwards into the obstacle for a reflection of the main wave, neither Tsingos nor Placko teach the contribution of the secondary wave being estimated by a dependency of the values of physical quantity chosen in step c) on a *predetermined coefficient of transmission of the main wave*.

Regarding claim 22,

Placko does not disclose furthermore formulating a *third interaction matrix* representing the contribution of the sources of the obstacle to the predetermined points of the surface of the radiating element, or *a fourth interaction matrix* representing the contribution of the sources of the radiating element to the predetermined points of the surface of the radiating element.

Regarding claim 25,

Placko teaches the value of each surface sample being determined as a product of a first vector normal to the surface sample and directed towards the apex of the hemisphere and a second vector drawn between a source associated with the hemisphere and the given region. However, Placko does not teach distinguishing between the case

where the scalar product is less than a predetermined threshold and the contribution of the source is not taken into account; and the case where the scalar product is greater than a predetermined threshold and the contribution of the source is actually taken into account.

Conclusion

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kimberly Thornewell whose telephone number is (571)272-6543. The examiner can normally be reached on 9am-5:30pm M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571)272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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